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ABSTRACT

Designed to measure by quantifiable means syntactic complexity component of readability, the Syntactic Complexity Formula is based on the theory that syntactic patterns frequently found in the language of children might be a more valid criterion than sentence length for controlling syntax. The Formula's analysis is based on transformational grammar theory, language performance studies, a review of experimental findings, and intuitions of the authors where experimental data is inconclusive. [This document is one of those reviewed in The Research Instruments Project (TRIP) monograph "Measures for Research and Evaluation in the English Language Arts" to be published by the Committee on Research of the National Council of Teachers of English in cooperation with the ERIC Clearinghouse on Reading and Communication Skills. A TRIP review which precedes the document lists its category (Reading), title, authors, date, and age range (primary, intermediate), and describes the instrument's purpose and physical characteristics.] (RB)

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CS 201354

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Category: Reading

Title: "Syntactic Complexity Formula"

Author: Morton Botel and Alvin Granowsky

Age Range: Primary, Intermediate

Description of Instrument:

Purpose - To measure by quantifiable means the syntactic complexity component of readability.

Date of Construction - 1972

Physical Description - Syntactic efforts to control readability have been minimal and limited to manipulations of sentence length. The grammatical makeup and complexity of a sentence, however, are not apparent from its length. Strickland[1] developed an instrument for the analysis of syntactic complexity that was rooted in structural grammar; and based on findings obtained through use of this instrument, proposed that syntactic patterns frequently found in the language of children might be a more valid criterion than sentence length for controlling syntax. In the Syntactic Complexity Formula, analysis of language is based on (1) transformational grammar theory, which is regarded as a more valid description of language than structural grammar, (2) language performance studies, indicating the frequency of usage of structures in the language of children, (3) a review of experimental findings, indicating the complexity with which syntactic structures are processed, and (4) intuitions of the authors where experimental data is inconclusive. Weighted syntactic structures are listed as follows:

[see following page]

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[1]Strickland, R. G. The language of elementary school children: its relationship to the language of the reading textbooks and the quality of reading of selected children. Bulletin of the School of Education, No. 38, 1962, Indiana University, Bloomington.

Summary of Complexity Counts

0-Count Structures

Sentence Patterns-two or three lexical items

1. Subject-Verb(Adverbial) He ran. He ran home.
2. Subject-Verb-Object (I hit the ball.)
3. Subject-be-Complement-(noun, adjective, adverb) He is good.
4. Subject-Verb-Invinitive (She wanted to play.)

Simple Transformations

1. interrogative (including tag-end questions) Who did it?
2. exclamatory (What a game!)
3. imperative (Go to the store.)

Coordinate Clauses joined by "and" (He came and he went.)

Non-Sentence Expressions (such as *Oh, Well, Yes, And then)*

1-Count Structures

Sentence Patterns-four lexical items

1. Subject-Verb-Indirect Object-Object (I gave her the ball.)
2. Subject-Verb-Object-Complement (We named her president.)

Noun Modifiers-

1. adjectives (big, smart)
2. possessives (man's, Mary's)
3. pre-determiners (some of, none of.... twenty of)
4. participles (in the natural adjective position: *crying* boy, *scalded* cat.)
5. prepositional phrases (The boy *on the bench...)*

Other Modifiers

1. adverbials (including prepositional phrases) when they do not immediately follow the verb in the SVAdv. pattern.)
2. modals (should, would, must, ought to, dare to, etc.)
3. negatives (no, not, never, neither, nor, -n't)
4. set expressions (once upon a time, many years ago, etc.)
5. gerunds (when used as a subject) *Running* is fun.
6. infinitives (when they do not immediately follow the verb in a SVInf. pattern) I wanted her *to play*.

Coordinates

1. coordinate clauses (joined by *but, for, so, or)* I will do it *or you will do it.*
2. deletion in coordinate clauses (John *and Mary,* swim or *fish:* a 1-Count is given for each lexical addition.)
3. paired coordinate "both . . . and" (*Both* Bob did it *and* Bill did it.)

2-Count Structures

Passives (I was hit by the ball. I was hit.)

Paired conjunctions (neither...nor, either ...or) *Either* Bob will go *or* I will.)

Dependent Clauses (adjective, adverb, noun) I went *before you did.*

Comparatives (as...as, same...as, -er than....,more...than) He is *bigger than you.*

Participles (ed or ing forms not used in the usual adjective position) *Running,* John fell. The cat, *scalded,* yowled.

Infinitives as Subjects (To *sleep* is important.)

Appositives (when set off by commas) John, *my friend,* is here.

Conjunctive Adverbs (however, thus, nevertheless, etc.) *Thus,* the day ended.

3-Count Structures

Clauses used as Subjects (What he does is his concern.)

Absolutes (The performance over, Mr. Smith lit his pipe.)

The syntactic complexity of any passage or sampling of sentences is the arithmetic average of the complexity counts of the sentences evaluated. The authors suggest that the Formula be regarded as a directional effort, that it not be considered a precise measuring instrument, and that it be used in conjunction with a measure of vocabulary.

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A Formula for Measuring Syntactic Complexity: A Directional Effort

Readability is a function of many variables. Chief among them are content, coherence, vocabulary load and syntactic complexity. Most people would agree that the first two, content and coherence, are basic factors in making a story "readable". In other words, a good story well presented will override other considerations in turning the young reader on.

Content and coherence, however, cannot be measured by quantifiable means, so in discussing readability we fall back on intuition and informal guidelines concerning these two essential factors. In practice, then, questions concerning the control of readability usually resolve themselves to: Given a good story and a good writer who can blend sentences together coherently, what can be done with vocabulary and syntax to make the story even more readable?

When it comes to controlling vocabulary, several sources are available which suggest the frequency of occurrence of words in oral and written language.[1] With these resources, it is generally believed that more readable materials can be written for children by using the frequently used words. Klare (1968) observed in his summary of research concerning the role of word frequency in determining readability:

> Frequency of occurrence of words, as this paper indicates clearly plays an all-pervasive role in language usage. Not only do humans tend to use some words more often than others, they recognize more frequent words more rapidly than less frequent, prefer them and understand and learn them more readily. It is not surprising, therefore, that this variable has such a central role in the measurement of readability. (p. 15)

To date syntax has played only a small role in controlling readability. As Strickland noted (1962), shortened sentence length appeared to be the only consistent syntactic control used in the basal readers analyzed. This finding could be anticipated from the fact that sentence length is the only syntactic measure in readability formulas generally used to control reading difficulty of elementary grade materials (for example, the Dale-Chall formula, 1948, and the Spache formula, 1953).

But sentence length offers little indication of the grammatical makeup and complexity of a sentence. As syntactic analyses based on transformational grammar indicate, the complexity of a sentence should not be

[1] The Teachers Word Book of 30,000 Words, Thorndike & Lorge
Predicting Readability Levels, Botel
The Spache Readability Formula
The Dale-Chall Readability Formula

judged from a word count of the sentence read. For example, Shakespeare's "To be or not to be: that is the question," would be rated as having primary level difficulty in terms of sentence length (and vocabulary frequency).

If as Klare observed, vocabulary frequency plays a powerful role in readability why shouldn't the frequency with which syntactic structures are used in the language of children also play an important role in determining which syntactic structures will be more easily read and understood by children? Indeed, Strickland (1962) developed an instrument for the analysis of syntactic complexity that was rooted in structural grammar; and based on findings obtained through use of this instrument, proposed that syntactic patterns frequently found in the language of children might be a more valid criterion than sentence length for controlling syntax. There is some research to support this hypothesis (Ruddell, 1963), but definitive work is needed.

Today transformational-generative grammar is regarded by many as a more valid description of language than structural grammar, suggesting that an instrument should be developed for measuring syntactic complexity based upon this theory. Toward this end, the Syntactic Complexity Formula[2] has been developed.

In the Syntactic Complexity Formula, analysis of language is based on transformational-generative grammar theory. Designation of syntactic complexity is derived from (1) transformational grammar theory, (2) language performance studies, indicating the frequency of usage of structures in the language of children, (3) a review of experimental findings, indicating the complexity with which syntactic structures are processed, and (4) intuitions of the authors where experimental data is inconclusive.

Decisions based on these criteria can be observed in the following listing of syntactic structures taken from the Syntactic Complexity Formula. The listing indicates the weightings (from 0 to 3) assigned syntactic structures. It is offered here with these cautions:

A. It should be used in conjunction with a measure of vocabulary.
B. It should not be considered a precise measuring instrument but rather a device for the identification of syntactic structures that affect readability and for the ranking of these structures in terms of their relative complexity.
C. It should be regarded as a directional effort still requiring further validation.

Summary of Complexity Counts

0-Count Structures

Sentence Patterns—two or three lexical items

1. Subject-Verb-(Adverbial) He ran. He ran home.
2. Subject-Verb-Object (I hit the ball.)
3. Subject-be-Complement-(noun, adjective, adverb) He is good.
4. Subject-Verb-Infinitive (She wanted to play.)

Simple Transformations

1. interrogative (including tag-end questions) Who did it?
2. exclamatory (What a game!)
3. imperative (Go to the store.)

Coordinate Clauses joined by "and" (He came and he went.)

Non-Sentence Expressions (such as *Oh, Well, Yes, And then*)

[2] Botel, M., Dawkins, J., Granowsky, A., *Syntactic Complexity: Analyzing It and Measuring It* (in press).

1-Count Structures

Sentence Patterns—four lexical items

1. Subject-Verb-Indirect Object-Object (I gave her the ball.)
2. Subject-Verb-Object-Complement (We named her president.)

Noun Modifiers

1. adjectives (big, smart)
2. possessives (man's, Mary's)
3. pre-determiners (some of, none of. . . . twenty of)
4. participles (in the natural adjective position: *crying* boy, *scalded* cat.)
5. prepositional phrases (The boy *on the bench*. . .)

Other Modifiers

1. adverbials (including prepositional phrases) when they do not immediately follow the verb in the SVAdv. pattern.)
2. modals (should, would, must, ought to, dare to, etc.)
3. negatives (no, not, never, neither, nor, -n't)
4. set expressions (once upon a time, many years ago, etc.)
5. gerunds (when used as a subject) *Running* is fun.
6. infinitives (when they do not immediately follow the verb in a SVInf. pattern) I wanted her *to play*.

Coordinates

1. coordinate clauses (joined by *but, for, so, or, yet*) I will do it *or you will do it*.
2. deletion in coordinate clauses (John *and Mary*, swim or *fish*: a 1-Count is given for each lexical addition.)
3. paired coordinate "both . . . and" (*Both* Bob did it *and* Bill did it.)

2-Count Structures

Passives (I was hit by the ball. I was hit.)

Paired conjunctions (neither . . . nor, either . . . or) *Either* Bob will go *or* I will.)

Dependent Clauses (adjective, adverb, noun) I went *before you did*.

Comparatives (as . . . as, same . . . as, -er than . . . . , more . . . than) He is *bigger than you*.

Participles (ed or ing forms not used in the usual adjective position) *Running*, John fell. The cat, *scalded*, yowled.

Infinitives as Subjects (*To sleep* is important.)

Appositives (when set off by commas) John, *my friend*, is here.

Conjunctive Adverbs (however, thus, nevertheless, etc.) *Thus*, the day ended.

3-Count Structures

Clauses used as Subjects (*What he does* is his concern.)

Absolutes (*The performance over*, Mr. Smith lit his pipe.)

Arithmetic Formula for Determining Average Syntactic Complexity

The syntactic complexity of any passage or sampling of sentences is the arithmetical average of the complexity counts of the sentences evaluated. For example if ten sentences had the following counts, their average syntactic complexity would be 2.5.

1. 2	6. 2	
2. 2	7. 1	
3. 3	8. 4	total 25
4. 1	9. 3	
5. 2	10. 5	average 2. 5

Programming Syntactic Complexity

Syntactic complexity of reading materials may be graded from a starting point of 0-count complexity to any *average* syntactic complexity count designated a terminal reading level.

For example, syntactic complexity of materials prepared for a primary reading program may begin at the 0-count level and progress to an average complexity count of 3.0 to 4.0.

There are a number of possible uses for the Syntactic Complexity Formula. Some of these are research uses, for example, comparative studies using the Strickland instrument and the Syntactic Complexity Formula; descriptive studies to determine whether material programmed on the basis of sentence length is in fact programmed in accordance with syntactic complexity; further validation of the weightings of syntactic structures based upon the ease with which children process these structures; studies of the oral and written language of children.

Practical uses of the formula include: as a guide to authors and editors of children's materials, as a readability device to determine reading difficulty of reading material, for use of the teacher in evaluating and giving direction to the language experience segment of the reading program.

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Stars

Stars shine bright
All through the night.
In the sky
Way up high.
Where the milky way
Makes a shiny street.

. . . Richard McDermott, Age 6

A Conversation

A flower talks to the bumble bee.
The bumble bee says buzz-buzz.
"Would you like to have some honey?"
"Oh, I haven't any money."

. . . Linda Wuersching, Age 6½